IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: **TORRISI ET AL.**

Serial No. **Not Yet Assigned**

Filing Date: **Herewith**

For: **A DRIVER CIRCUIT FOR SOFT TURNING ON A POWER ELEMENT CONNECTED TO AN INDUCTIVE LOAD**

I HEREBY CERTIFY THIS PAPER OR FEE IS BEING DEPOSITED WITH THE U.S. POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER 37 CFR 1.10 ON THE DATE INDICATED BELOW AND IS ADDRESSED TO: BOX PATENT APPLICATIONS, ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231.

EXPRESS MAIL NO: EL747059820US

DATE OF DEPOSIT: January 15, 2002

NAME: Dawn Kimler

SIGNATURE: Dawn Kimler

PRELIMINARY AMENDMENT

Director, U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

Prior to the calculation of fees and examination of the present application, please enter the amendments and remarks set out below.

In the Drawings:

Submitted herewith is a request for proposed drawing modifications as indicated in red ink to label FIGS. 1-5 as prior art. FIGS. 1, 5 and 6 are also being modified as indicated in red ink to label the blocks therein.

In the Claims:

Please cancel Claims 1 to 14.

Please add new Claims 15 to 51.

15. A driver circuit for driving a power element connected to an inductive load, the driver circuit

comprising:

an input terminal connected to a conduction terminal of the power element, and an output terminal connected to a control terminal of the power element;

a first current generator connected between a voltage reference and the output terminal for providing a first charge current to the control terminal of the power element; and

a second current generator connected in parallel with said first current generator between the voltage reference and the output terminal for providing a second charge current to the control terminal of the power element, the second charge current being based upon a voltage at the input terminal.

16. A driver circuit according to Claim 15, further comprising:

a switch connected between said second current generator and the output terminal; and

a voltage sense-and-compare circuit connected between a drive terminal of said switch and the input terminal.

17. A driver circuit according to Claim 16, wherein said voltage sense-and-compare circuit comprises a sensing block, and a voltage comparator cascade connected to said sensing block.

18. A driver circuit according to Claim 17,

wherein said voltage comparator comprises a first input connected to an output of said sensing block, a second input connected to an internal voltage reference, and an output connected to the drive terminal of said switch.

19. A driver circuit according to Claim 15, wherein the first and second charge currents have different values.

20. A driver circuit according to Claim 19, wherein the first charge current is less than the second charge current.

21. A driver circuit according to Claim 15, wherein said voltage sense-and-compare circuit opens said switch for disconnecting said second current generator from the output terminal when the voltage at the input terminal begins to decrease, thereby enabling the control terminal of the power element to be charged with the first charge current when the power element initiates a turn-on.

22. A driver circuit according to Claim 17, wherein said sensing block differentiates the voltage at the input terminal.

23. A driver circuit according to Claim 17, wherein said sensing block comprises a junction capacitor of a high-voltage integrated diode.

24. A driver circuit according to Claim 15, wherein each of said first and current generators comprises:

a resistor connected to the voltage reference; and

a transistor comprising a first conduction terminal connected to said resistor, and a second conduction terminal connected to the output terminal;

the driver circuit further comprising a respective enabling transistor connected to a control terminal of a corresponding transistor.

25. A driver circuit according to Claim 18, wherein said switch comprises a first transistor connected to the voltage reference, and said first transistor comprises a control terminal connected to the output of said voltage comparator.

26. A driver circuit according to Claim 25, wherein said switch further comprises a second transistor comprising a first conduction terminal connected to the voltage reference, and a control terminal connected to a conduction terminal of said first transistor.

27. A driver circuit according to Claim 26, further comprising a mirror transistor connected between a second conduction terminal of said second transistor and said second current generator.

28. A driver circuit according to Claim 18, further comprising an internal generator for generating the

internal voltage reference, said internal generator being connected to the voltage reference and comprising an output connected to the second input of said voltage comparator.

29. A driver circuit according to Claim 15, wherein the power element comprises an IGBT transistor, and the conduction terminal of the power element is a collector terminal of said IGBT transistor.

30. A driver circuit for driving an IGBT transistor connected to an inductive load, the driver circuit comprising:

an input terminal connected to a conduction terminal of the IGBT transistor, and an output terminal connected to a control terminal of the IGBT transistor;

a first current generator connected between a voltage reference and the output terminal for providing a first charge current to the control terminal of the IGBT transistor;

a second current generator connected in parallel with said first current generator between the voltage reference and the output terminal for providing a second charge current to the control terminal of the IGBT transistor, the second charge current being based upon a voltage at the input terminal; and

a switch connected between said second current generator and the output terminal for disconnecting said second current generator from the output terminal so that the control terminal of the IGBT transistor is charged with

the first charge current when the power element initiates a turn-on.

31. A driver circuit according to Claim 30, further comprising a voltage sense-and-compare circuit connected between a drive terminal of said switch and the input terminal.

32. A driver circuit according to Claim 31, wherein said voltage sense-and-compare circuit comprises a sensing block and a voltage comparator cascade connected to said sensing block.

33. A driver circuit according to Claim 32, wherein said voltage comparator comprises a first input connected to an output of said sensing block, a second input connected to an internal voltage reference, and an output connected to the drive terminal of said switch.

34. A driver circuit according to Claim 30, wherein the first and second charge currents have different values, and the first charge current is less than the second charge current.

35. A driver circuit according to Claim 30, wherein said voltage sense-and-compare circuit opens said switch for disconnecting said second current generator from the output terminal when the voltage at the input terminal begins to decrease.

36. A driver circuit according to Claim 30, wherein each one of said first and current generators comprises:

a resistor connected to the voltage reference; and

a transistor comprising a first conduction terminal connected to said resistor, and a second conduction terminal connected to the output terminal;

the driver circuit further comprising a respective enabling transistor connected to a control terminal of a corresponding transistor.

37. A driver circuit according to Claim 33, wherein said switch comprises:

a first transistor connected to the voltage reference, and said first transistor comprises a control terminal connected to the output of said voltage comparator; and

a second transistor comprising a first conduction terminal connected to the voltage reference, and a control terminal connected to a conduction terminal of said first transistor.

38. An electronic ignition system comprising:

a power element; and

a driver circuit for driving said power element and comprising

an input terminal connected to a conduction terminal of said power element, and an output terminal connected to a control terminal of said

power element,

a first current generator connected between a voltage reference and the output terminal for providing a first charge current to the control terminal of said power element, and

a second current generator connected in parallel with said first current generator between the voltage reference and the output terminal for providing a second charge current to the control terminal of said power element, the second charge current being based upon on a voltage at the input terminal.

39. An electronic ignition system according to Claim 38, further comprising:

a switch connected between said second current generator and the output terminal; and

a voltage sense-and-compare circuit connected between a drive terminal of said switch and the input terminal.

40. An electronic ignition system according to Claim 39, wherein said voltage sense-and-compare circuit comprises a sensing block, and a voltage comparator cascade connected to said sensing block.

41. An electronic ignition system according to Claim 38, wherein the first charge current is less than the second charge current.

42. An electronic ignition system according to Claim 39, wherein said voltage sense-and-compare circuit opens said switch for disconnecting said second current generator from the output terminal when the voltage at the input terminal begins to decrease, thereby enabling the control terminal of said power element to be charged with the first charge current when the power element initiates a turn-on.

43. An electronic ignition system according to Claim 40, wherein each of said first and current generators comprises:

a resistor connected to the voltage reference; and

a transistor comprising a first conduction terminal connected to said resistor, and a second conduction terminal connected to the output terminal;

the driver circuit further comprising a respective enabling transistor connected to a control terminal of a corresponding transistor.

44. An electronic ignition system according to Claim 38, wherein said switch comprises:

a first transistor connected to the voltage reference, and said first transistor comprises a control terminal connected to an output of said voltage comparator.

a second transistor comprising a first conduction terminal connected to the voltage reference, and a control terminal connected to a conduction terminal of said first transistor.

45. A method for driving a power element connected to an inductive load using a driver circuit comprising an input terminal connected to a conduction terminal of the power element, and an output terminal connected to a control terminal of the power element, the method comprising:

delivering a first charge current to the control terminal of the power element; and

delivering a second charge current to the control terminal of the power element, the second charge current being based upon on a voltage at the input terminal.

46. A method according to Claim 45, wherein the first charge current is provided by a first current generator, and the second current is provided by a second current generator connected in parallel to the first current generator; the method further comprising using a switch connected between the second current generator and the output terminal for disconnecting the second current generator from the output terminal.

47. A method according to Claim 46, wherein the second current generator is disconnected from the output terminal when the voltage at the input terminal begins to decrease, thereby enabling the control terminal of the power element to be charged with the first charge current when the power element initiates a turn-on.

48. A method according to Claim 46, further comprising driving the switch using a voltage sense-and-

compare circuit connected between a drive terminal of the switch and the input terminal.

49. A method according to Claim 46, wherein each of the first and current generators comprises:

a resistor connected to the voltage reference; and

a transistor comprising a first conduction terminal connected to the resistor, and a second conduction terminal connected to the output terminal;

the driver circuit further comprising a respective enabling transistor connected to a control terminal of a corresponding transistor.

50. A method according to Claim 46, wherein the switch comprises:

a first transistor connected to the voltage reference, and the first transistor comprises a control terminal connected to an output of the voltage sense-and-compare circuit; and

a second transistor comprising a first conduction terminal connected to the voltage reference, and a control terminal connected to a conduction terminal of said first transistor.

51. A method according to Claim 45, wherein the power element comprises an IGBT transistor, and the conduction terminal of the power element is a collector terminal of the IGBT transistor.

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REMARKS

It is believed that all of the claims are patentable over the prior art. For better readability and the Examiner's convenience, the newly submitted claims differ from the translated counterpart claims which are being canceled. The newly submitted claims do not represent changes or amendments that narrow the claim scope for any reason related to the statutory requirements for patentability. Accordingly, after the Examiner completes a thorough examination and finds the claims patentable, a Notice of Allowance is respectfully requested in due course. Should the Examiner determine any minor informalities that need to be addressed, he is encouraged to contact the undersigned attorney at the telephone number below.

Respectfully submitted,

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EXPRESS MAIL NO: EL747059820US

DATE OF DEPOSIT: January 15, 2002

NAME: Dawn Kimler

SIGNATURE: Dawn Kimler

SUBMISSION OF PROPOSED MODIFICATIONS TO DRAWINGS

Director, U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

Submitted herewith is a request for proposed drawing modifications as indicated in red ink to label FIGS. 1-5 as prior art. FIGS. 1, 5 and 6 are also being modified as indicated in red ink to label the blocks therein.

Respectfully submitted,

Michael W. Taylor

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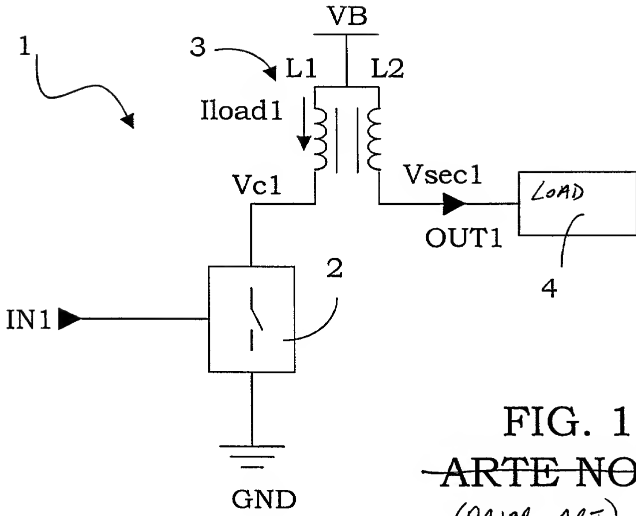

FIG. 1

~~ARTE NOTA~~

(PRIOR ART)

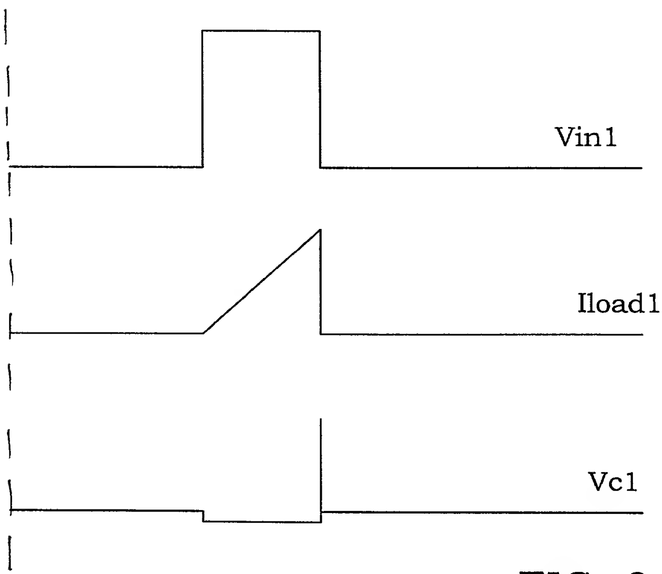

FIG. 2

~~ARTE NOTA~~

(PRIOR ART)

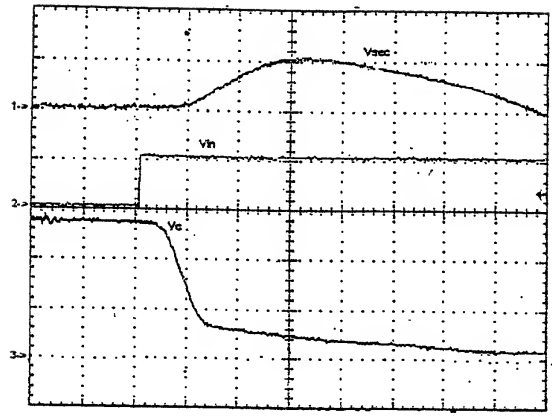

FIG. 3
(PRIOR ART)

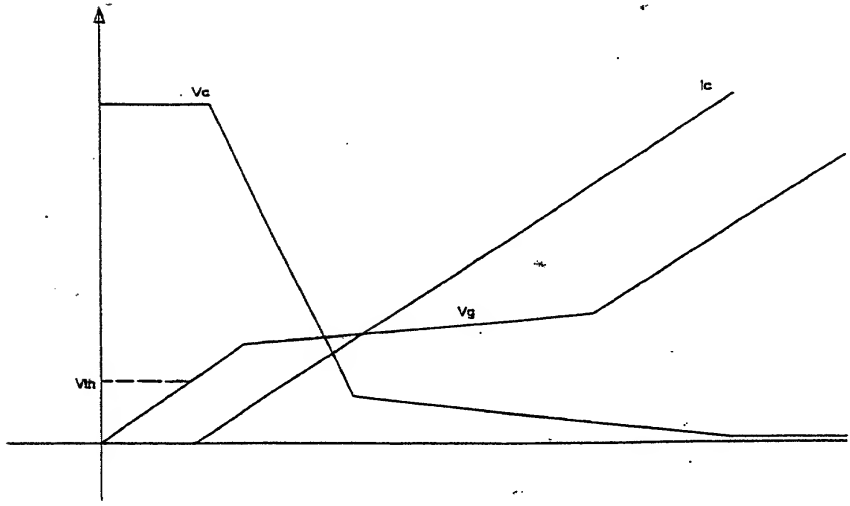

FIG. 4
(PRIOR ART)

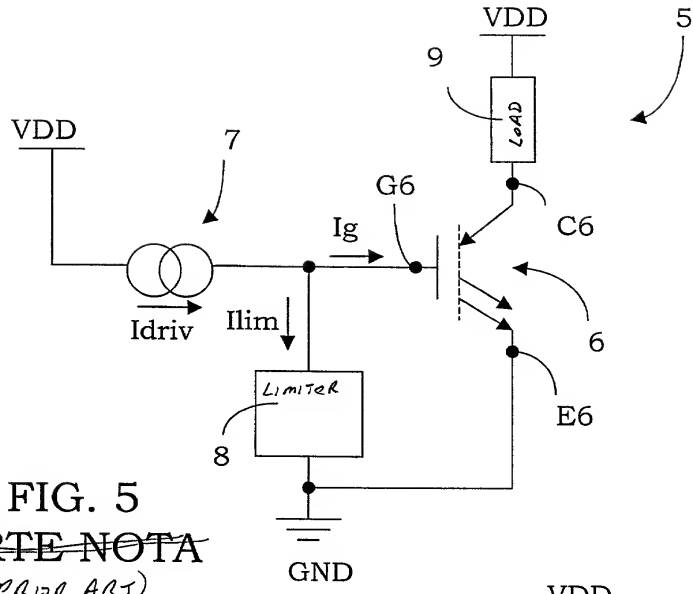

FIG. 5

~~ARTE NOTA~~

(PRIOR ART)

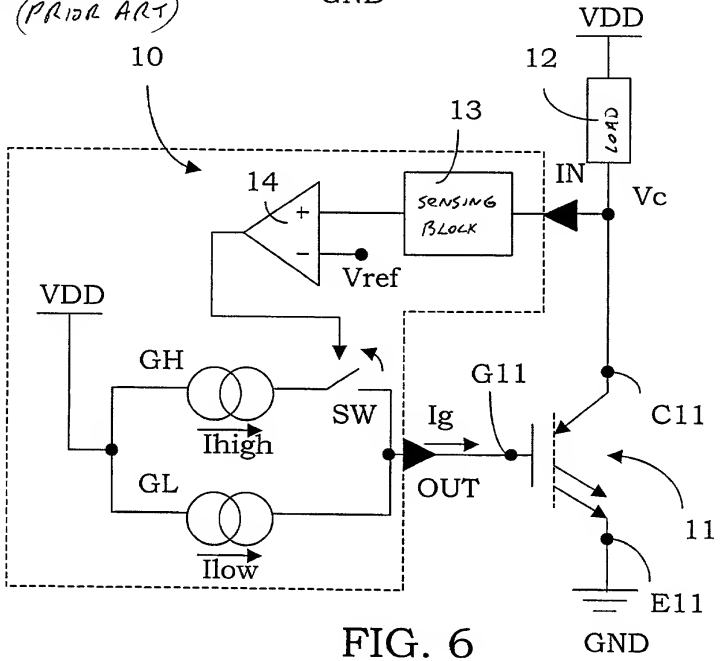

FIG. 6